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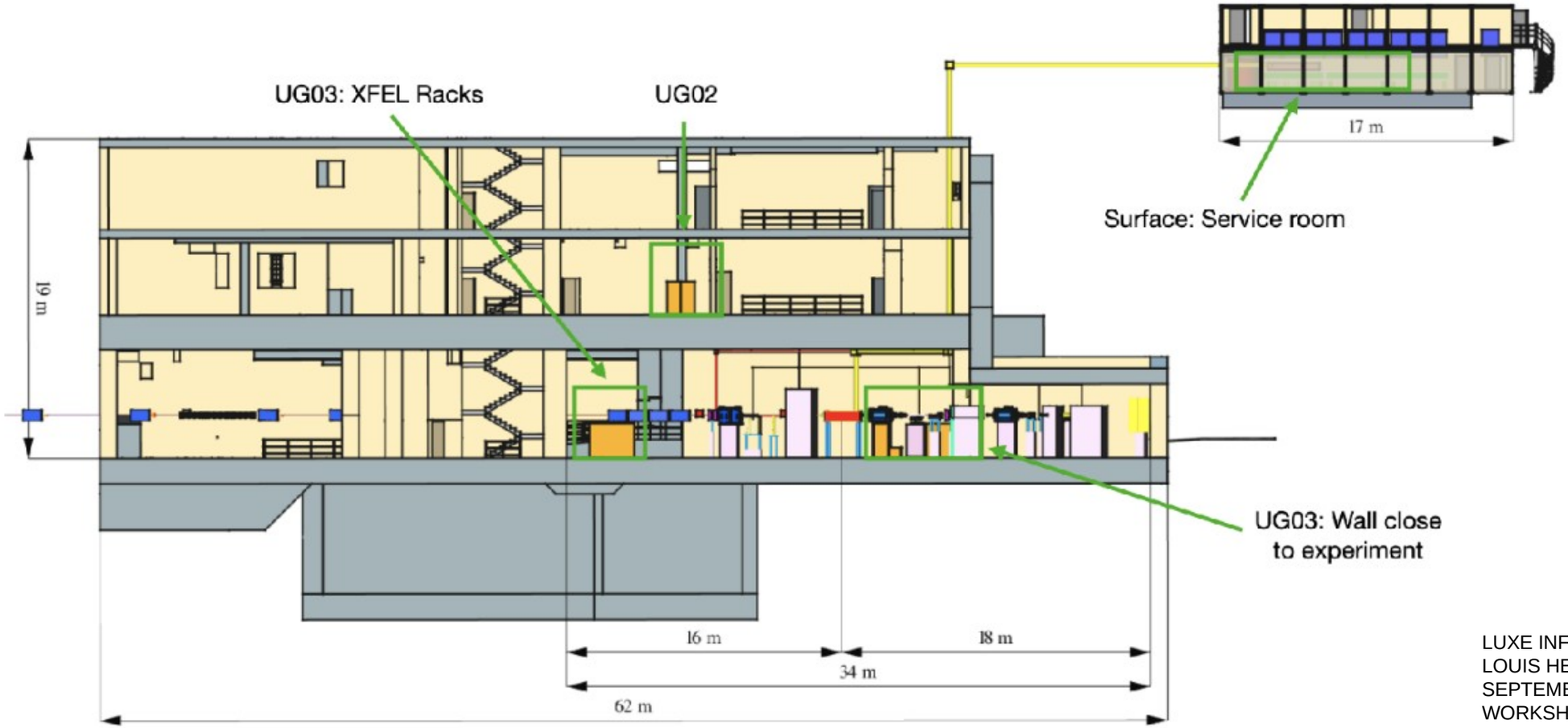
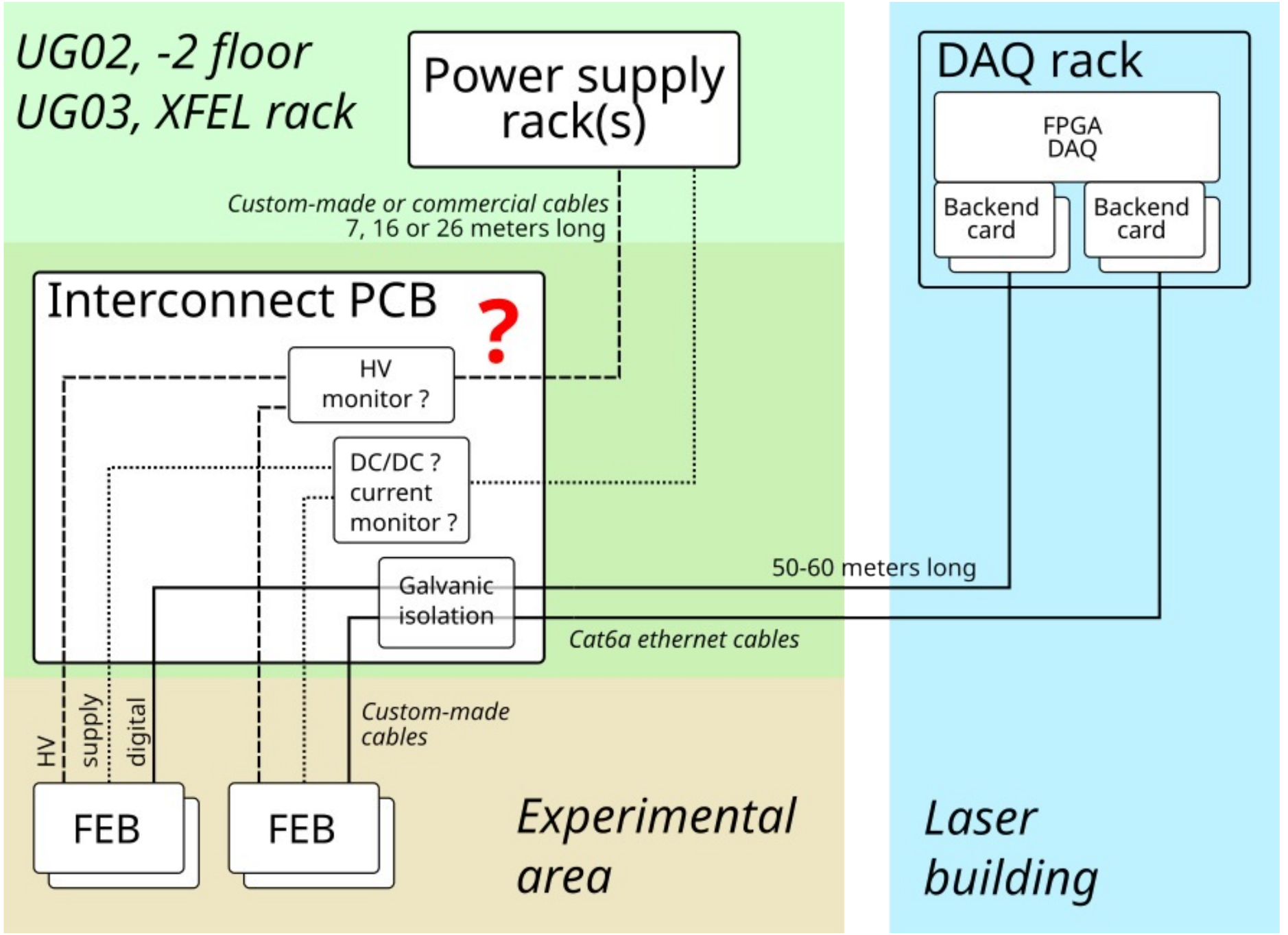
LUXE meeting summary from hardware point of view: topics we need to discuss (soon!)

ECAL working group meeting @ LUXE Collaboration Meeting,
Weizmann Institute of Science, Rehovot, 3-13 SEP-2023



- **Position foreseen for backend electronics:**
  - In UG03 (not accessible during data-taking).
  - In UG02 (potentially accessible at every time but for short stay and space limited).
  - In surface building (further away), space to be understood.

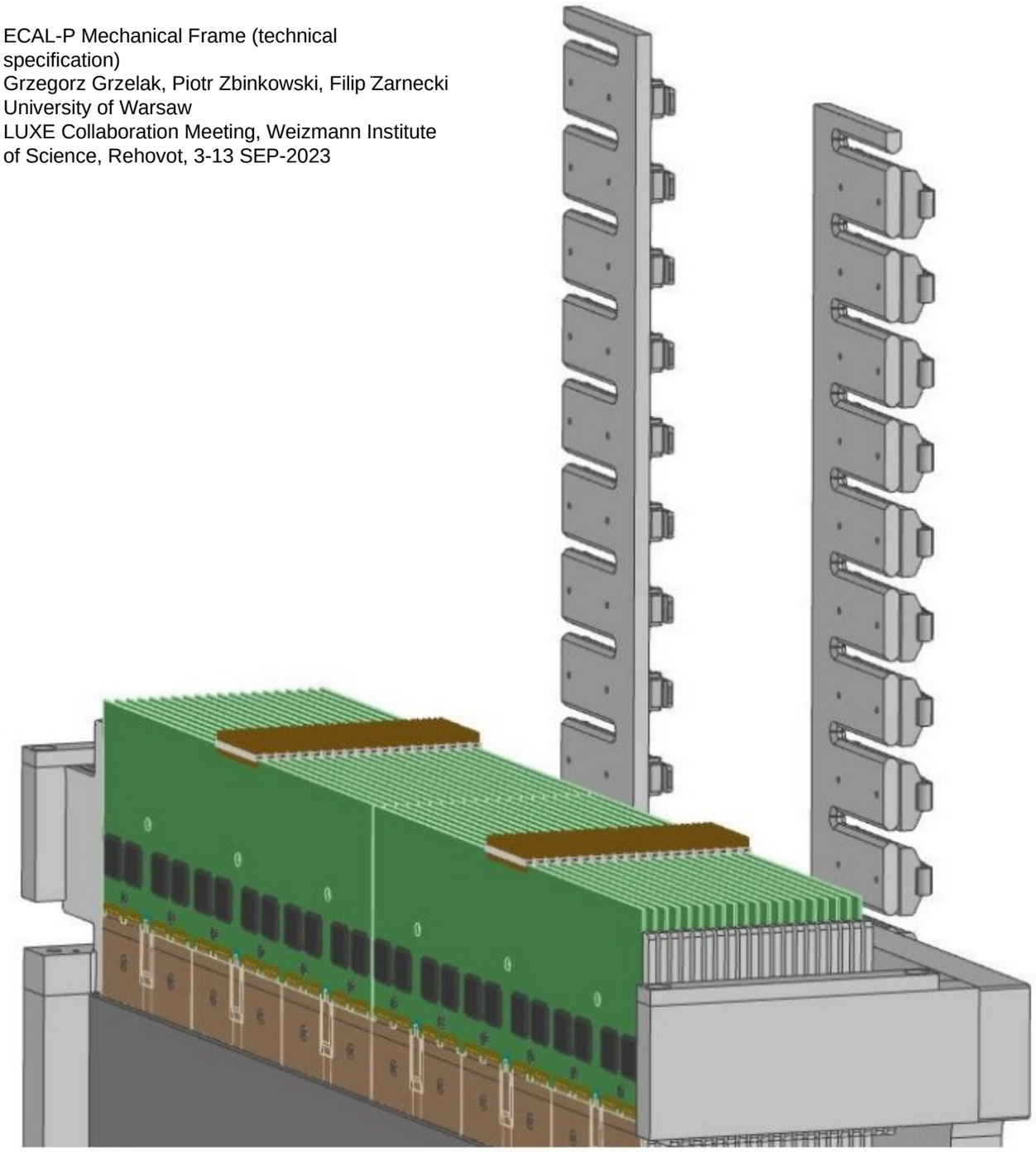
Area	Length
UG03: Side north wall	7 m
UG03: EuXFEL rack	16 m
UG02	26 m
Surface: service room	≈ 50 m

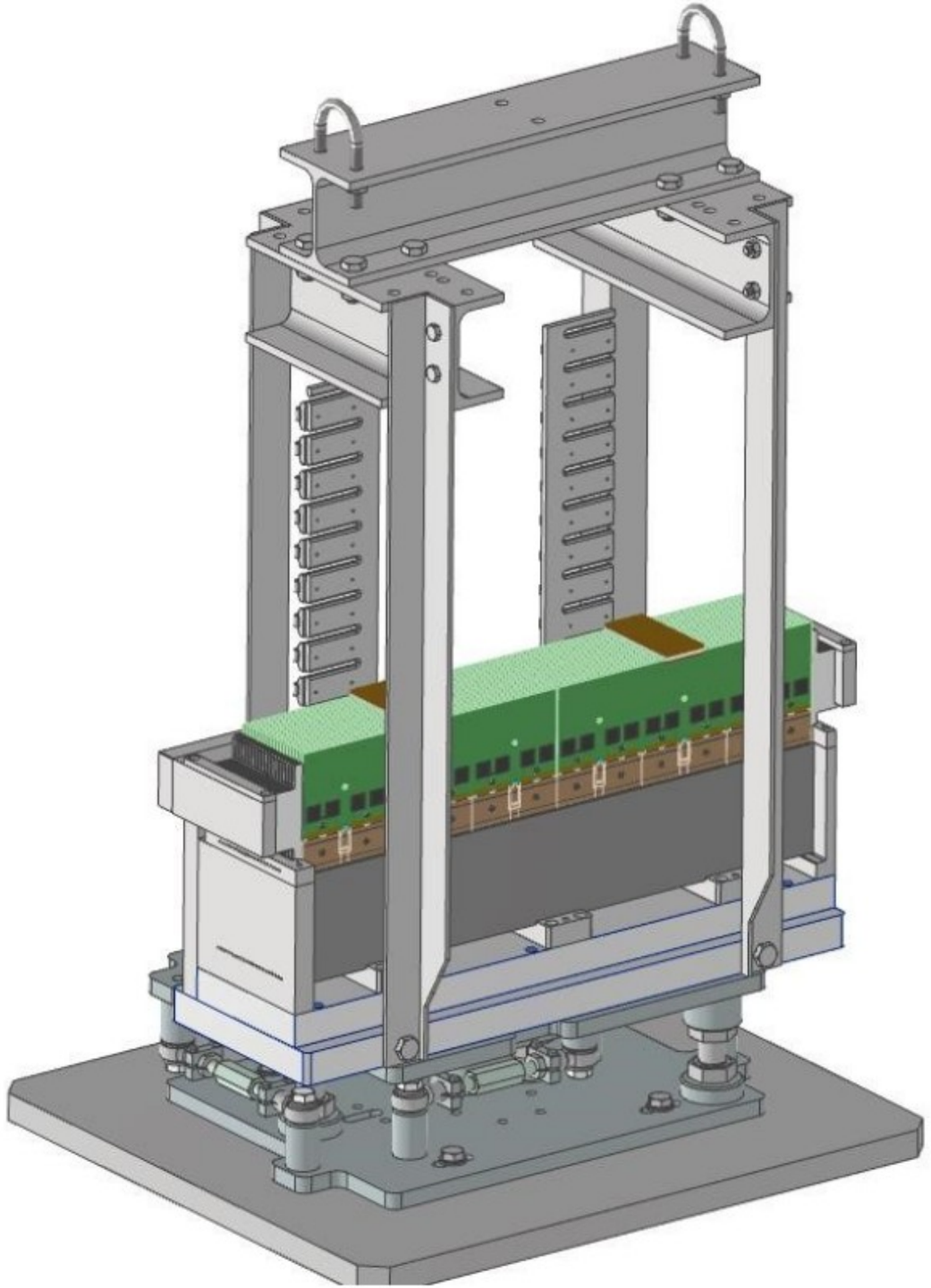

UG02, -2 floor
UG03, XFEL rack
Power supply rack(s)
Custom-made or commercial cables
7, 16 or 26 meters long
DAQ rack
FPGA DAQ
Backend card
Backend card
Interconnect PCB
?
HV monitor ?
DC/DC ? current monitor ?
Galvanic isolation
50-60 meters long
Cat6a ethernet cables
HV
supply
digital
Custom-made cables
FEB
FEB
Experimental area
Laser building

ECAL-P Mechanical Frame (technical specification)

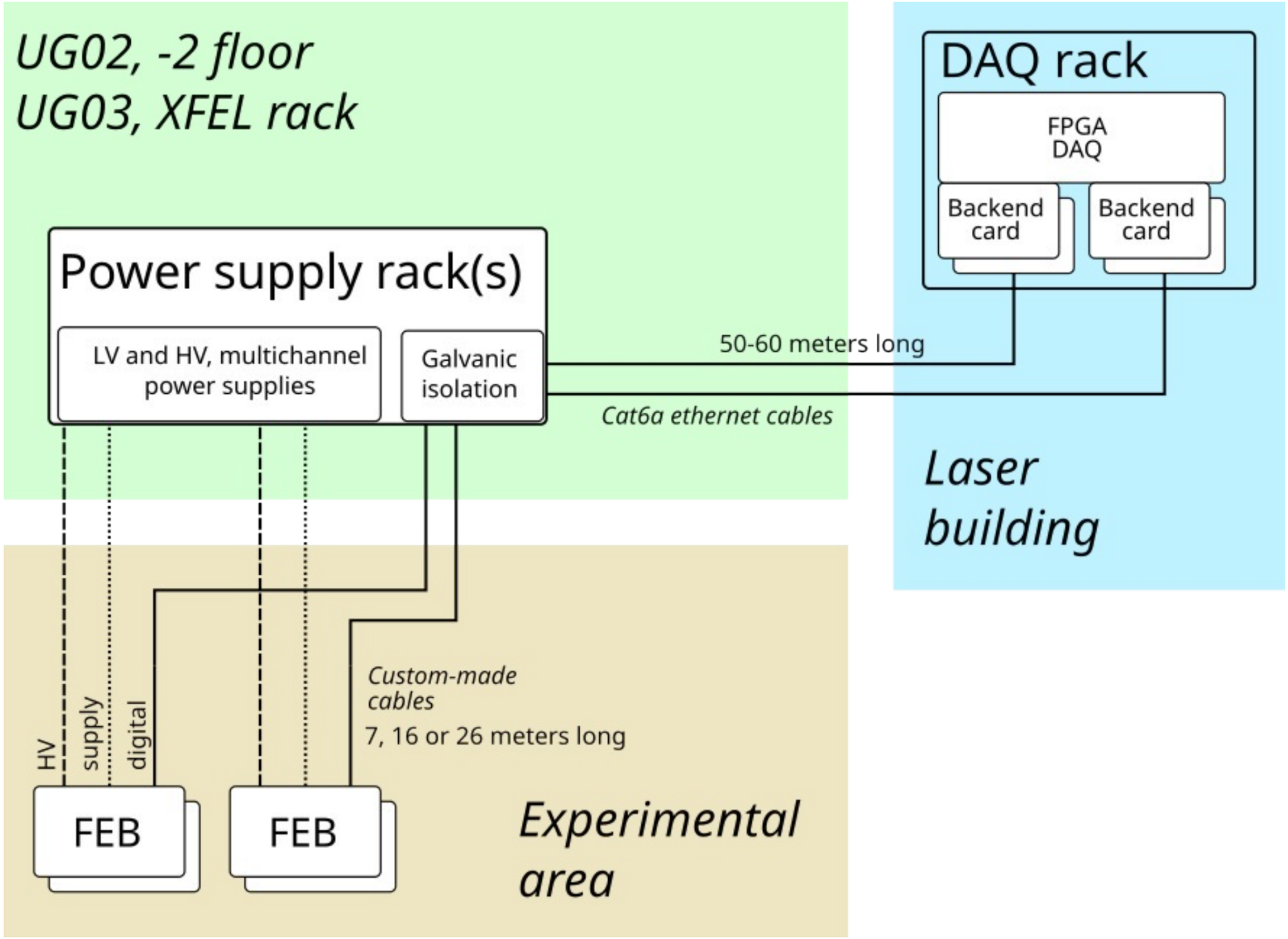
Grzegorz Grzelak, Piotr Zbinkowski, Filip Zarnecki
University of Warsaw

LUXE Collaboration Meeting, Weizmann Institute of Science, Rehovot, 3-13 SEP-2023






Jerzy Kossak
1928


UG02, -2 floor
UG03, XFEL rack
DAQ rack
FPGA DAQ
Backend card
Backend card
Power supply rack(s)
LV and HV, multichannel power supplies
Galvanic isolation
50-60 meters long
Cat6a ethernet cables
Laser building
HV
supply
digital
Custom-made cables
7, 16 or 26 meters long
FEB
FEB
Experimental area

Remarks and conclusions (general to whole LUXE):

- We are dealing (due to the dumps) with radiation levels comparable to some places of the LHC experiment caverns
- We may need (at least) rad-tolerant components (mainly for power supply). Commercial grade power supplies are NOT rad tolerant
- LUXE needs a valid and complete FLUKA simulations of the whole area

Remarks and conclusions (continued):

- We (AGH) need to prepare “portable” versions of DAQ hardware, dedicated for 1–2(?) FEBs, working with TLU, for lab. measurements at IFIC & TAU (and also first testbeams)

- FLAXE ASIC does not have the self-trigger mode
  1) We can read up to 2k events / s from a single ASIC, but dead time is 497.5us (99.5%) Un-trigerred measurements (e.g. with radiation source) are not possible!

  2) We have to use cosmic muons to verify sensor after gluing → we need scintillator, TLU-compatible PMT (from DESY?), and a TLU for Adrian

- Fanout (signal and HV) – another generous contribution from Yan who will design fanouts for us (thank you very much!)
  1) I can help and contribute (e.g. do the routing)
  2) We (AGH) would like to validate the final design performance through simulations with FLAXE ASIC. We will need 2–4 weeks to do it before manufacturing of the flex.

Topics for near future discussions:

- We absolutely need dose & neutron flux estimations in the readout electronic volume
  Sasha generously agreed to do the simulation for us – warmest thanks to Sasha!
  1) The result may (hopefully will not) influence the FEB location and size
  2) The interconnect PCB location (and existence) will depend on radiation levels

- Do we have magnetic field in the readout electronic volume?

- How are we going to supply the readout and sensors (LV and HV supplies):
  1) Who is going to be responsible for LV and HV supply?
  2) Which manufacturer / model we want to use and how we want to control them?
  *CAEN HV supply hosted by the rack with DC/DC supply gave us **HUGE** noise in TB22!*

- How to monitor sensor leakage current (and FEB consumption) during the experiment?
  1) Itamar's idea: a remotely controlled switching matrix allowing to bias only one FEB at the time and measure the current using the HV supply between runs (*we have doubts*)
  2) Can we afford ~30–40 channels of HV / LV power supplies?
  3) Any other ideas?

Topics for near future discussions (continued):

- For how many layers we should prepare readout:
  1) 15
  2) 20

- Where we want (and where we can) put our power supplies and DAQ rack(s)?

- Readout electronics will work with power pulsing in the experiment, reducing power consumption 10-50 times.
  We need to operate ECAL-P without it (no reduction) for final testbeam(s).
  Most likely the readout electronics, working in continuous mode, will need cooling.
  1) Difficult, but not impossible during the testbeam – we have to think how to do it?
  2) Are we going to operate in continuous mode inside experimental area?